Poly silicon TFT magnet sensors
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This paper deals with magnetic position sensors compatible with large area electronics and amorphous low cost substrates. The principle of this large area position sensor is a matrix of polysilicon thin film field effect transistors (TFT) with two additional Hall probes. Position is determined by the measurement of the Hall voltage induced by the magnetic field of a permanent magnet for each elementary cell.

TFT magnet sensors have to present a good sensitivity for a low power consumption. The performances of the TFTs based cells are linked to the crystalline quality of the active polysilicon layer, which depends on the deposition conditions and on technological process. In the case of polycrystalline silicon deposited by a low-pressure chemical reaction technique (LPCVD), they also depend on the nature of the precursor gases.

Different structures are realized in order to improve the devices characteristics. These studies are made for N-type and P-type channel TFTs. First, we improved the performances by working on the active layer deposition. Indeed, we showed [1] that a low doping of this layer allows to improve the thin film transistor characteristics (field effect mobility) and the sensor response. Moreover, layers made from two precursor gases, silane or disilane previously developed on TFTs for AMLCD application were used for these sensors [2,3]. For the disilane, the grain size of the film is much larger than for silane and the device presents a better sensitivity. The electrical characterization of transistors have shown that the highest field effect mobility is reached with disilane based layer (100 cm²/V.s compared to 60 cm²/V.s). We have compared the sensitivity (absolute or relative) of devices and measured their power consumption in order to find the best bias conditions for the best sensitivity. Sensors made from silane have a sensitivity of 12 mV/T, those from disilane have a sensitivity of 18 mV/T with a low power consumption and a drain voltage limited to 8V.

As the performances also depend on technological process, especially the presence or not of defects between the source (or drain) region and the active channel region, two processes called double or monolayer (active layer and highly doped contacts deposited during the same run) were used for these sensors. In spite of a lower field effect mobility (around 80 cm²/V.s), the sensors made with a monolayer process shows a better sensitivity of 28mV/T with a power consumption lower than 4mW.

The offset voltage is also compared with the output voltage (i.e. the Hall voltage) in order to determine the role of geometry and of the layer morphology.

In order to improve the sensor sensitivity and to explain the relationships between the layer morphology and the sensor characteristics, the performances of the sensors with different processes of fabrication are analysed and a model is developed.

